

### **DETAILED ACTION**

1. Claims 1, 5, 7-10, 14, 16, and 18-26 are pending. Claims 2-4, 6, 11-13, 15, and 17 have been canceled. Note that, Applicant's amendments and arguments filed 5/29/07 have been entered.

### ***Priority***

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed in parent Application No. 10/240,848 filed on 10/4/02.

### **Objections/Rejections Withdrawn**

The following objections/rejections as set forth in the Office action mailed 8/22/07 have been withdrawn:

The rejection of claims 1, 5, 7-10, 13, 14,16, 18, 19, and 23-26 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement has been withdrawn.

The rejection of claims 1, 5, 7-10, 13, 14,16, 18, 19, and 23-26 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention has been withdrawn.

The rejection of claims 1, 5, 7-10, 16, 18-20, and 23-26 under 35 U.S.C. 103(a) as being unpatentable over WO 01/33613 in view of Vaartstra (US 6,242,165) and Skee et al (US 5,989,353) has been withdrawn due to the incorporation of the limitations of claim 13 into each of the independent claims.

Art Unit: 1796

The rejection of claims 1, 5, 7-10, 14, 16, 18-20, and 23-26 under 35 USC 103(a) as being unpatentable over Xu et al (US 2003/0125225) in view of Skee et al (US 5,989,353) has been withdrawn due to the incorporation of the limitations of claim 13 into each of the independent claims.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 5, 7, 8, 10, 14, 16, 18-20, and 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee (US 6,306,564) in view of Vaartstra (US 6,242,165) and Skee et al (US 5,989,353).

Mullee teaches a commercially available solvent, such as a stripping chemical and/or an organic solvent, is supported by supercritical CO<sub>2</sub> to remove a resist, its residue, and/or an organic contaminant off the surface of a semiconductor wafer. See Abstract. Preferred types of chemicals include N-methyl pyrrolidone, diglycol amine, hydroxyl amine, catechol, tertiary amines, ammonium fluoride, ammonium bifluoride, etc. Other chemicals such as an organic solvent may be used independently or added to one or more of the chemicals to remove organic contaminants from the wafer surface. These solvents include an alcohol, dimethyl sulfoxide, methanol, ethanol, etc. See column 4, lines 10-30. Although conventionally large amounts of chemicals can be used, it is preferred to introduce each of these chemicals or mixtures of chemicals in an amount that is less than about 15% by volume. See column 4, lines 30-38.

Mullee does not teach an alkyl ammonium fluoride, a quaternary ammonium hydroxide, or a cleaning composition containing carbon dioxide, an alkyl ammonium fluoride compound, a quaternary ammonium hydroxide, a cosolvent, and the other requisite components in the specific proportions as recited by the instant claims.

Vaartstra teaches a method for removing organic material in the fabrication of structures including providing a substrate assembly having an exposed organic material and removing at least a portion of the exposed organic material using a composition having at least one component in a supercritical state. See Abstract. Additionally, other components may be added to the compositions to enhance the organic material removal process. Buffering agents such as ammonium fluoride, tetramethyl ammonium

fluoride, surfactants, etc., may be added to the compositions. See column 6, lines 10-25.

Skee et al teach microelectronics substrates which are cleaned to remove metal contamination while maintaining wafer substrate surface smoothness by contacting the wafer substrate surfaces with an aqueous cleaning solution of an alkaline, metal ion-free base and a polyhydroxy compound. See Abstract. Suitable alkaline components include tetramethylalkyl ammonium hydroxide, tetraethyl ammonium hydroxide, 2-methyl-1, 5-pentanediamine, monoethanolamine, etc. See column 5, lines 1-25.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to use tetramethyl ammonium fluoride in the cleaning composition taught by Mullee, with a reasonable expectation of success, because Vaartstra teaches the equivalence of tetramethyl ammonium fluoride to ammonium fluoride in a similar cleaning composition and further, Mullee teaches the use of ammonium fluoride.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to use tetramethylammonium hydroxide in the composition taught by Mullee, with a reasonable expectation of success, because Skee et al teach the equivalence of quaternary ammonium hydroxide to various amines as an alkaline compound in a similar cleaning composition and further, Mullee teaches the use of alkaline compounds including various amines.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to formulate a cleaning composition containing carbon dioxide, a fluoride compound, a quaternary ammonium hydroxide, a cosolvent, and the other

requisite components in the specific proportions as recited by the instant claims, with a reasonable expectation of success and similar results with respect to other disclosed components, because the broad teachings of Mullee in combination with Vaartstra and Skee et al suggest a cleaning composition containing carbon dioxide, a fluoride compound, a quaternary ammonium hydroxide, a cosolvent, and the other requisite components in the specific proportions as recited by the instant claims.

Claims 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee (US 6,306,564) in view of Vaarstra and Skee et al (US 5,989,353) as applied to the rejected claims above, and further in view of McCullough et al (US 5,976,264).

Mullee, Xu et al, and Skee et al are relied upon as set forth above. However, none of the references teach the use of methane or a fluorosurfactant in addition to the other requisite components of the composition as recited by instant claims 21 and 22.

McCullough et al teach a method for the removal of fluorine or chlorine residue from an etched precision surface such as a semiconductor sample which comprises exposing said precision surface to liquid CO<sub>2</sub> under appropriate conditions that are sufficient to remove the residue from the precision surface. See Abstract. The preferred supercritical fluid is carbon dioxide which may be used alone or in admixture with another additive such as H<sub>2</sub>O, Ar, NH<sub>3</sub>, methane, etc. Surfactants which aid in removing the reactive ion etching residue from the semiconductor sample containing at least one CF<sub>x</sub> functional group may also be used in conjunction with a supercritical fluid. See column 5, lines 5-30.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to use methane in the cleaning composition taught by Mullee with a reasonable expectation of success, because McCullough et al teach the equivalence of methane to carbon dioxide as a supercritical fluid in a similar cleaning composition and further, Mullee teach the use of carbon dioxide as a supercritical fluid.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to use a surfactant containing at least one  $CF_x$  functional group in the composition taught by Mullee with a reasonable expectation of success, because McCullough et al teach the use of a surfactant containing at least one  $CF_x$  functional group aid in semiconductor residue removal in a similar composition which would be desirable in the compositions taught by Mullee.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee (US 6,306,564) in view of Vaarstra and Skee et al (US 5,989,353) as applied to claims 1, 5, 7, 8, 10, 14, 16, 18-20, and 23-26 above, and further in view of McCullough et al (US 5,976,264) or WO01/33613.

Mullee, Vaarstra, and Skee et al are relied upon as set forth above. However, Mullee do not teach the use of water in addition to the other requisite components of the composition as recited by the instant claims.

McCullough et al are relied upon as set forth above.

'613 teaches a method of removing photoresist and residue from a substrate by maintaining supercritical carbon dioxide, an amine, and a solvent in contact with the substrate so that the amine and the solvent at least partially dissolve the photoresist

Art Unit: 1796

and the residue. See Abstract. Preferable amines include (2-(methylamino)ethanol, PMDETA, triethanolamine, etc. Preferably, the solvent is selected from DMSO, ethylene carbonate, N-methylpyrrolidone, BLO, acetic acid, etc. See page 5, lines 5-30. One embodiment of the invention includes a composition containing an aqueous fluoride such as ammonium fluoride, an amine, and solvent for cleaning photoresists. See page 10, lines 25-35.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to use water in the cleaning composition taught by Mullee, with a reasonable expectation of success, because McCullough et al teach the equivalence of  $H_2O$  to carbon dioxide as a supercritical fluid in a similar cleaning composition and, further, Mullee teaches the use of supercritical  $CO_2$ .

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to use water in the cleaning composition taught by Mullee, with a reasonable expectation of success, because '613 teaches the use of aqueous solutions of ammonium fluoride in a similar cleaning composition and, further, Mullee teaches the use of ammonium fluoride in general which usually is formulated as an aqueous solution.

### ***Response to Arguments***

With respect to the rejection of the instant claims under 35 USC 103(a) using Mullee in combination with Vaartstra and Skee et al, Applicant states that while Vaartstra is relied upon for its teaching of the equivalence of tetramethyl ammonium fluoride to ammonium fluoride, a Declaration has been provided under 37 CFR 1.132



which shows that ammonium fluoride is not equivalent to tetramethyl ammonium fluoride in a supercritical state. Thus, Applicant states that one of ordinary skill in the art would not be motivated to use tetramethyl ammonium fluoride in the cleaning composition taught by Mullee. In response, note that, the Examiner asserts that the Declaration filed under 37 CFR 1.132 is not sufficient to show that ammonium fluoride and tetramethylammonium fluoride are not equivalents in a supercritical composition. Specifically, the 132 Declaration does not provide any numeric or objective data showing the differences between supercritical compositions containing ammonium fluoride in comparison to those compositions containing tetramethyl ammonium fluoride, but merely provides technical reasoning which the Examiner does not find persuasive.

Additionally, the instant specification itself recognizes the equivalency of ammonium fluoride to tetramethylammonium fluoride as demonstrated by page 4, lines 1-15 and original claims 1-4 in which ammonium fluoride (all groups being hydrogen - claim 3) and tetramethyl ammonium fluoride (claim 4) are claimed as being equivalent fluoride compounds as basic agents. Thus, the Examiner maintains that in the absence of data showing the unexpected and superior properties of the claimed invention in comparison to compositions falling outside the scope of the instant claims, the Declaration is not sufficient to place the instant claims in condition for allowance and the teachings Mullee in combination with Vaartstra and Skee et al are sufficient to reject the instant claims under 35 USC 103(a).

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory R. Del Cotto whose telephone number is (571) 272-1312. The examiner can normally be reached on Mon. thru Fri. from 8:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Pyon can be reached on (571) 272-1498. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Gregory R. Del Cotto/  
Primary Examiner, Art Unit 1796

/G. R. D./  
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